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METHODS AND USES OF GRAFTING AND BUDDING

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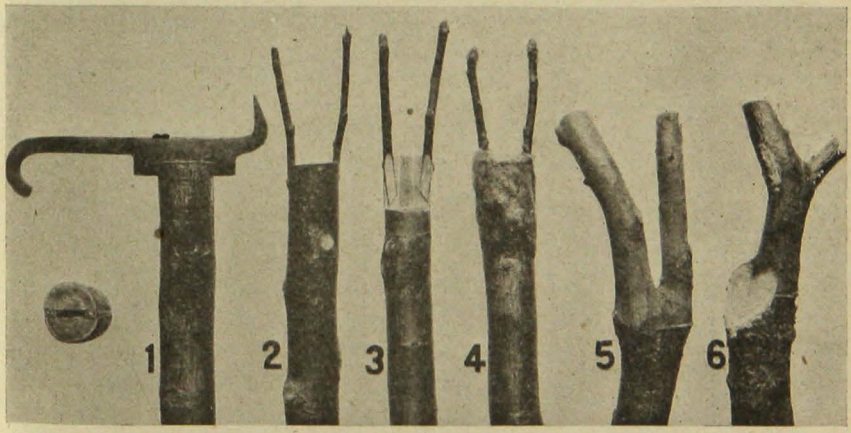
The art of grafting trees and plants has long been known to horticulturists, and has been used for three general purposes. The first is in the production of nursery trees, when the variety desired is grafted or budded on a seedling root; the second is in top working trees of a worthless variety in order to change them to a valuable one or to grow several sorts on one tree. The third use is in the treatment of trees injured by disease or girdled by rodents.



Cleft Grafting: 1. Stock cut off and grafting chisel in position to open cleft. 2. Scions in place. 3. Top stock cut away to show scions in proper position. 4. Graft completed and waxed. 5. Both scions growing at end of first season. 6. Growth from one scion cut away to prevent crowding. At left of 1 is a view from above (cross section) of scions in place.

The principle involved in all grafting is to bring together the growing parts of the scion and stock in order to effect a union at the point of junction. The stock is the plant or root that the grafting is to be done on; the scion is the new wood that is to be grown. The growing part of all hardwood plants

(except those with large central piths, such as palms) is located in the inner bark or the cambium layer lying between the wood and bark. Thus, in making any graft, it is necessary that the cambium layer of the stock and scion touch in one or more places. It is also essential to exclude the air from the union to prevent the cut surface of both stock and scion from drying out and dying before a real union can take place. This is accomplished by the use of grafting wax which is applied thoroly over all cut surfaces of both the stock and the scion at the point where the graft is made. All grafting operations except as otherwise noted in the following discussion should be performed in the early spring just before the buds start into active growth.

Collecting scion wood.—The scion, or part to be grafted into a tree, should be selected from a strong, healthy shoot of the last season's growth. It is best to collect these shoots during the early part of the winter and pack them away in a cool cellar in damp sawdust to prevent their drying out. If they are allowed to remain on the tree until the time of the grafting, they may be injured by severe winter weather or the buds may have started to swell during the first warm days of spring. It is important that the scion-wood be absolutely dormant. In preparing the scions for grafting, two or three inches of the base of the shoot is usually discarded because the buds are poorly developed, and the tips are not used because the wood is soft and pithy.

Grafting wax.—A good grafting wax may be made by using the following ingredients:

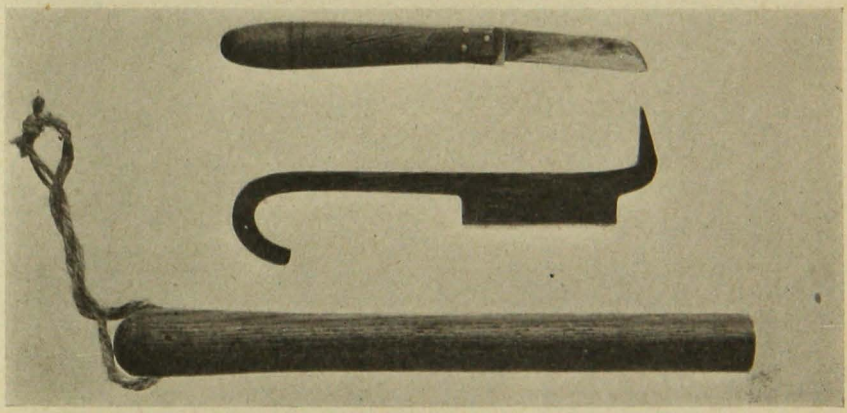
4 parts resin
2 parts bees-wax
1 part tallow

Melt the ingredients over a slow fire. If the resin is in lumps, it should be pulverized before it is put over the fire to facilitate melting. All particles of the resin should be completely melted before the wax is removed from the fire. Allow it to cool somewhat and pour into a tub of cold water. With the hands well greased to prevent sticking, it may then be pulled and worked like molasses candy until it assumes a smooth grain, when it may be rolled into suitable sized balls and put away on waxed or oiled paper until ready for use. It will keep indefinitely.

Grafting tools.—Very few special tools are required for successful grafting. One essential thing is that the knife be sharp and have a smooth cutting edge. A knife with a straight edge similar to the one shown in the illustration is preferable to a round pointed knife. For top working large trees, a grafting chisel is almost a necessity. A local blacksmith can readily make one from an old file. A curved handle as illustrated in the cut is a convenience, enabling one to hang the tool over a limb when not in use. The mallet for driving the grafting chisel into the stub may be readily improvised from any convenient piece of wood. A good pruning saw should be provided. Either

the ordinary narrow bladed hand-saw, commonly sold for pruning purposes, or the swivel blade pruning saw is good for this purpose. In no case would the pruning saw with teeth on both sides be recommended, as one is almost certain to injure the tree with the back of the saw when the cutting is done in close quarters. A good pair of hand pruning shears about nine or ten inches long is also a great convenience in grafting work and is pretty nearly a necessity to one who has any amount of pruning to do.

The whip graft.—Perhaps the most useful of all forms of grafting is the whip graft, which may be used on small branches in top-working trees or for root grafting in nursery tree propagation. In making a whip graft, the stock should be cut off just above a smooth spot free from knots. A smooth beveled cut from an inch to an inch and a half long should be cut at the top of the stock. If the stock is small, this cut may extend

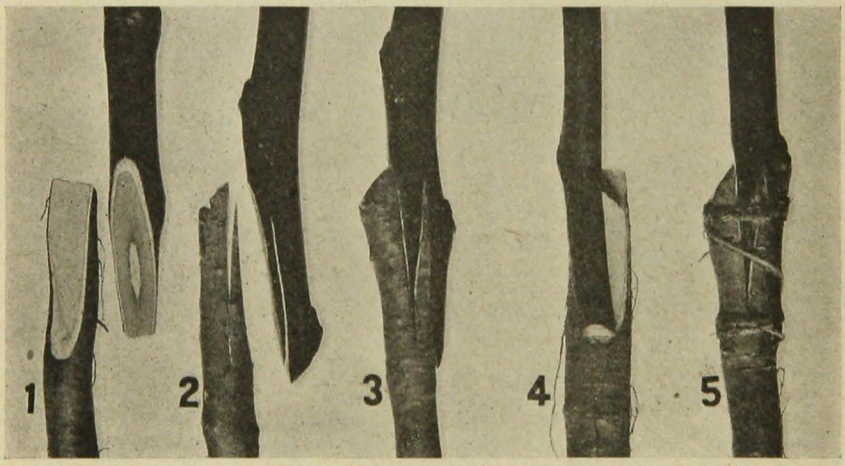


Grafting Tools; Knife (Top), Grafting Chisel (Center), Mallet (Bottom)

clear across, but when a branch ⅜ inch or more in diameter is to be worked, it is better to make the beveled cut along one side of the stock and not reaching quite to the pith. Next, a tongue should be cut beginning about one-third of the distance from the tip of the bevel, and cutting downward about one-third of the length of the original beveled cut. Avoid starting the cut through the pith. To secure a smooth surface on the inside of the tongue, it should be cut and not split. The scion may now be similarly prepared, beginning the first beveled cut opposite the base of a bud and making sure that the cut is approximately the same length as in the stock. After the tongue is cut in the scion, the two pieces are fitted firmly together, care being taken that the inner bark along one side is in contact. The scion should be cut about three to four inches long and should carry three or four buds. The two pieces are then bound together with ordinary

cotton twine and thoroly covered with wax about the union and on the top of the scion. The wax may best be used by melting it and applying with a brush or swab. After growth is well started, the string binding the two parts together should be slit along the back of the graft to prevent girdling.

In the propagation of nursery trees, seedling roots are secured and cut up into about four-inch lengths. Each piece of the root is then used as a stock and a scion about six inches long is whip-grafted to the upper end of the root. The two are then bound together with waxed string* or waxed strips of cloth. Waxing is unnecessary since the grafts will not dry out when packed in damp material and are later planted in moist ground. The whip grafts are then tied up in bundles and packed away in a cool cellar in damp sand or sawdust. The grafts should be made



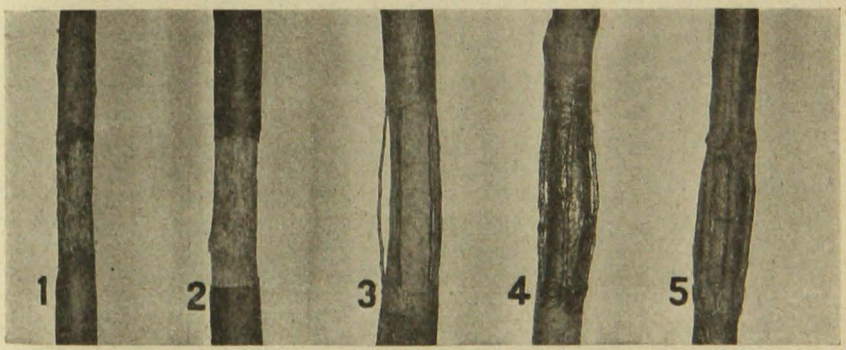
Whip Grafting: 1. First bevel cut through top of stock and bottom of scion. 2. Tongue cut in both before joining as in 3. 3. Side view. 4. Front view showing bark in contact on one side. 5. Completed graft tied with waxed string and ready for packing in damp sand or sawdust.

during January or February, and by the time they are taken out of the cellar for planting in the nursery, it will be found that the union and the cut surfaces at the bottom of the root will be nicely covered with a heavy callous. In planting the root grafts, they should be firmly set in an upright position with the upper bud projecting above the top of the ground. They may be set in rows four feet apart and six or eight inches apart in the row.

Cleft grafting.—The cleft graft is used in top-working large trees, the branches of which are an inch or more in diameter. The limbs that are to be grafted are cut off squarely with a saw at a point which is free from knots. The stub is then split down-

*Waxed string may be prepared by dipping a ball of No. 18 cotton string into melted grafting wax until thoroly saturated. Waxed strips of cloth are similarly prepared.

ward through the center by means of a grafting chisel and then the crack held open by the wedge shaped portion of the chisel. The scions are prepared by cutting the base in a wedge shape, having the inner edge of the wedge narrower than the other. The wedge is then set into the cleft in the stock with the thin edge toward the inside and set at a slight angle so that the bark on the outer part of the wedge crosses the cambium layer of the stock at least at one point. Unless the stock is very small, two scions are usually placed in the cleft and the area of the union covered with wax. The scion tip and the open crack down the sides of the stock must also be thoroly covered with wax. It is not necessary to tie or bind these scions in place as the spring of the wood holds them firmly. In top-working large trees it is not advisable to top-work the entire tree in one year, but to extend the process over two or three years, thus removing not more than a third or a half of the entire tree-top at one time.



Bridge Grafting: 1. Girdled tree trunk. 2. Girdled area cleaned and ready for scions. 3. Scions in position. 4. All parts waxed. 5. Growth at end of first season.

Bridge grafting.—The bridge graft is used entirely for repairing injured trees and not for propagation. Its most frequent use comes in the treatment of trees which have been girdled during the winter by mice or rabbits. It is also useful in saving trees that are severely affected with collar rot. It has also been successfully used by tree surgeons when they have wanted to cover a filled cavity quickly with growing tissue. It is simply a bridging over of the girdled space by means of scions which are inserted both top and bottom and which will, when united with the stock, transport food materials downward across the girdled area, and keep the tree alive. In making the bridge graft the girdled surface should first be trimmed to a clean, smooth cut edge, both top and bottom. The scion wood is then selected of sufficient length to reach entirely across the girdled area. The base of the scion is cut clear across with a beveled cut about an inch and a half long. After this cut is made, the scion should be measured against the girdle to find its proper length and then the

upper part of the scion should be beveled similarly to the bottom and on the same side. The bark above and below the girdle is then slit with a knife and the edges are loosened. The beveled base of the scion is then inserted in the slit in the bark below the girdle with the beveled cut on the inner side against the wood of the tree. It is pushed firmly downward until the entire bevel is embedded in the slit bark. It should then be held firmly in place with one hand while with the other hand, grasping the scion near the top it should be bent in a bow shape until the upper bevel can be inserted into the upper slit of the bark and pushed upward into place. The now straightened scion should stand reasonably close to the trunk. Both the top and the bottom of the scion should then be tacked firmly to the tree by a small slender brad. Repeat this process until the trunk of the tree is surrounded by these scions about an inch and a half apart. The point of union at both ends of the scion should be thoroly waxed and it is usually best either to wax or to paint the bare wood of the tree to keep it from drying out.

Sometimes it is impossible to attach the lower part of the scion to the base of the tree because so much of the cambium layer has been destroyed by disease. In such cases small trees may be planted close to the trunk and grafted into the main tree above the affected tissue. The small trees are cut to the proper height, the top beveled, and then slipped under the edge of the cambium layer, after which it is treated as a bridge graft. Many valuable trees have been saved in this way and the method has been found quite effective in saving collar rotted trees.

In a few years these scions will increase in size until they completely cover the girdled trunk with a shell of new, actively growing wood and bark. Trees treated in this way will not suffer in the slightest degree even during the first season after grafting, provided most of the scions make a successful union.

BUDDING

Budding is many times considered to be a process altogether different from grafting, but in reality the two are almost identical.

The operation consists in inserting a single, detached bud under the bark of the stock. Usually only stocks of one or two years' growth are used because older wood does not work so easily. Budding should be done in late July or early August when the bark is loose enough to peel, and when mature buds are available from new growth of the current season. Occasionally nurserymen collect dormant buds in winter and use them for spring budding after growth is started, but this is not recommended for topworking.

There are no hard and fast rules as to whether budding or grafting is to be preferred. Stone fruits, roses, and lilacs are usually budded. Apples and pears may be either grafted or budded.

Care should be used in selecting the buds that are to be set. Those at the tip of the bud stick should not be used, for they may be weak and immature owing to poor growth. Those at the lower end are usually small and undeveloped. It is best to take the plump, full buds near the center of the bud stick; that is, if there is plenty of material available. From the illustration it will be seen that the bud is cut with bark attached above and below. This increases the amount of cambium on the bud that will come in contact with the cambium on the stock so that

Budding: 1. Stock with cross and longitudinal cuts. 2. Buds cut partly off. 3. Bud. 4. Bud inserted. 5. Cuts tied with raffia. 6. Bud started and stock cut off.

there will be a better chance for union. The little plate of wood at the back is usually not removed if it has been cut thin and without pith. In summer budding it is customary to cut the bud so that not over one-half inch of the stem of the leaf is attached. This makes it more convenient to handle, and in some cases may protect the bud. A smooth place on the stock should be selected and sprouts and leaves should be rubbed off to facilitate setting the bud. It is well to insert the buds on the north side of a seedling to prevent drying by the sun but this is not feasible as a rule in topworking young trees.

The cut for the insertion of the bud should be made "T" shaped. The horizontal cut is usually made first, and then the

vertical one is made towards the horizontal one from below. At the point where they unite, the knife is turned so that the bark is lifted on each side of the vertical cut. This makes it very easy to insert the bud. It should be pushed down under the flaps of bark far enough to permit tying down the upper corners of the flaps, as this tends to prevent drying. After the bud is put into place it is tied with raffia as shown in the illustration and left to heal. It is not necessary to cover the cut surfaces with wax because the raffia protects them from the air. Success often depends upon the tying. The ties should be tight enough to hold the bud securely in place.

Ten days or two weeks after the work has been done the stock should be gone over and the bands cut so that there will be no binding of the wood due to rapid growth.

The bud will remain dormant till the following spring, just "sticking" in place and waiting to grow. A few days before growth starts the stock should be cut off an inch above the inserted bud. A very strong growth will be made the first year because the strong root provides the new bud an abundance of food. Under favorable conditions, a plum tree in the nursery may attain a height of from four to six feet and be ready for market in the fall. It is necessary to inspect the budded trees two or three times during the early part of the growing season and to rub off buds which start from the stock and which would otherwise choke out the growth of the inserted bud.

Among the plants that are usually budded, the rose is perhaps the most satisfactory for the beginner to practice on. Usually hardy stock is used such as the wild roses. If some care is taken not to let the plant tissue dry, there is little chance of failure. The newly set bud should be shaded for a few days with a little damp moss, or a cabbage leaf may serve very satisfactorily in order to protect the bud while it is recovering from the operation.

In topworking young apple trees two buds are usually inserted on the leader and on each of the best scaffold branches. It is usually best to set these buds at the side of the branches, as the growth from a bud set underneath a branch often is misshapen. Budding also is commonly used after whipgrafting on the apple. If a graft fails, buds may be set on sprouts from the stock and a completely topworked head obtained in a short time.